

# A Review on Reproductive and Neurobehavioral Effect of Pesticide lambda-cyhalothrin

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## ABSTRACT

A synthetic pyrethroid used as an insecticide is called lambda-cyhalothrin (LCT). Investigation of LCT's effects on neurobehavioral and reproductive effects was the study's main objective. Therefore, the existing study was designed to investigate the effect of LCT on the reproductive and neurobehavioral effects. In this study found reproductive toxicity, hepatotoxicity, nephrotoxicity, and splenotoxicity and also showed reduced testosterone levels and ovarian alteration. Also found neurotransmitter levels and AChE and Na<sup>+</sup>/K<sup>+</sup>-ATPase activities are suppressed.

**KEYWORDS:** *Lambda-cyhalothrin, Pyrethroids, Mammals, Testosterone, AChE*

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## INTRODUCTION

Three million acute poisoning cases and 220,000 deaths from pesticide exposure are recorded annually throughout the world. Also, those who have experienced continuous exposure may experience neurobehavioral abnormalities and an increased risk of developing cancers such as leukemia, non-lymphoma, Hodgkin's, and multiple myeloma (El-Bendary *et al.*, 2010). An insecticide called pyrethroid, lambda-cyhalothrin (LCT). Synthetic versions of pyrethrins, which are naturally occurring insecticidal substances produced in chrysanthemum blooms (*Chrysanthemum cinerariaefolium*) are known as pyrethroids. Pyrethroids are divided into two categories: type I compounds lack a -cyano group in their structure, while type II compounds have -cyano groups in their structure (Soderlund, 2012). Pyrethroid-based insecticides have been used extensively to manage insect pests in homes, gardens, public spaces, and agriculture (Amweg and Weston 2005; Oros and Werner 2005). Pyrethroids have a high level of effectiveness and are far more harmful to insects than to mammals. Pyrethroids cause

neurotoxicity in both mammals and insects (the target animals) by acting on neurons' voltage-gated sodium channels (which are non-target organisms). Mammals also have target sites for insecticidal activity, which are voltage-sensitive sodium channels. However there are several sodium channel isoforms in mammals, and each one has unique biophysical and pharmacological characteristics. Pyrethroids also affect calcium and chloride channels that are sensitive to voltage. This is due to animals' limited cutaneous absorption and their quick conversion to non-toxic metabolites. Consuming pyrethroid residues can cause dysphagia, a sore throat, nausea, vomiting, stomach pain, mouth ulcers, and increased secretions (Brasberry *et al.*, 2005). Pyrethroids are neurotoxic insecticides that are frequently employed to manage home and agricultural insect pests.

The chromosomal aberrations, tissue damage, and bone marrow micronuclei generation caused by LCT have all been demonstrated in mice (Çelik *et al.*, 2003, Fetoui *et al.*, 2010).

Many organs and systems may be negatively impacted (nervous, endocrine, reproductive, and immune, among others) (Costa *et al.*, 2006). According to the US Environmental Protection Agency, environmental endocrine disruptors are "exogenous agents that interfere with the synthesis, secretion, transport, binding action, or elimination of natural hormones in the body that are necessary for the maintenance of homeostasis, reproduction, development, or behaviour." The endocrine system of animals may be harmed by a huge variety of synthetic substances that have been released into the environment (Colborn, 2002)

### Reproductive effect of LCT:

The nature of pyrethroids is antiandrogenic. These substances may interact with, stimulate, or impair the activity of androgen receptors (Pesticide Action Network, 2000). Through reducing testicular LH receptors and spermatogenesis, increased glucocorticoids also directly inhibit the generation and secretion of testosterone (Sarkar *et al.*, 2003). showed severe vacuolation, degenerative ovarian changes, mature oocytes, and granulosa cells, whereas showed more pronounced degenerative ovarian alterations, flabby structures, and mature oocytes (Ezenwosu *et al.*, 2021). The amount of total free amino acids in the treated fish's ovary was dramatically decreased (Ahmad *et al.*, 2012). Seminiferous tubules with very few spermatogenic cells or cell debris as well as a complete absence of mature spermatozoa in the tubular lumen were found to have degenerated spermatogenic cells (Nkontcheu *et al.*, 2017). The number of sperm was significantly decreased, testicles severely degenerated, and the number of abnormal sperm cells increased (Yekeen *et al.*, 2016). Reported that treatment with lambda-cyhalothrin reduced testosterone levels, feed intake, body weight (BW) and relative testes (RTW), and epididymis (REW) weights in rabbit (Yousef, 2010). A study found that LCT could cause male reproductive toxicity, hepatotoxicity, nephrotoxicity, and splenotoxicity in male mice at the tested levels (Al-Sarar *et al.*, 2014). According to a study, the pesticide LCT led to several malformations in the newborn female mice who were exposed to it. Although the newborn's morphology was roughly normal, the head of the infant was smaller and curvier from top to bottom (Malahi *et al.*, 2022).

### Neurobehavioral effect of LCT:

In developing rats exposed to lambda-cyhalothrin, inhibition of ChAT and AChE activity may result in the down-regulation of muscarinic-cholinergic receptors, which would then impede learning function (Ansari *et al.*, 2012). Serum amino acid

neurotransmitter levels and AChE and Na<sup>+</sup>/K<sup>+</sup>-ATPase activities are suppressed, and there are changes in the amounts of these substances in the brain were reported (Frag *et al.*, 2021). These neurotoxic effects are brought about by brain oxidative stress, which leads to an inflammatory response, and by modulating the expression of genes that encode stress. Specifically, PEO and BF co-supplementation. It was noted that Lambda-cyhalothrin significantly reduced the amount of AChE in the brain (Bibi *et al.*, 2014). A pathological analysis of a rat's brain revealed lymphocytic aggregation, congested meningeal blood vessels, degenerative changes to the nerve fibers, necrotic alterations to some neurons, and pericellular and perivascular edema. It also revealed degenerative changes to the nerve fibers were detected (El-Bendary *et al.*, 2010). The lambda-cyhalothrin-exposed brain tissues showed the greatest rise in AChE activity and inhibition of AChE activity. As a result, the changes in AChE activity showed that the pesticides employed were very neurotoxic to fish, and the enzyme (AChE) might be used as a helpful biomarker for the assessment of water pollution (Amin *et al.*, 2022). According to a study, rats treated with LCT at low and high doses had considerably lower levels of serotonin in their brain and cerebellum than control group rats (Chakroborty *et al.*, 2018).

### Conclusion:

All reported studies in humans or animals supported the idea that pesticides induced reproductive and neurobehavioral effects of their toxic action in the body. Regarding the involvement of reproductive and neurobehavioral effects in the pathophysiology of many debilitating chronic diseases in humans or animals, more attention to the reduction of pesticide uses in the environment is suggested.

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